



ROOT CAUSE ANALYSIS OF THE MOST FREQUENTLY OCCURRING PROBLEMS IN THE IRAQI BUILDING INDUSTRY THROUGH FISHBONE DIAGRAM

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ABSTRACT

Disputes are major causes of poor performance in construction projects. Escalated disputes result in complicated disagreements whose resolutions are expensive, take longer, and impact relationships. Disputes management has a powerful function to ensure successful performance. Identifying the most frequent claims and disputes from past projects, their origins and causes could be a sturdy policy for effective management. This study aims to diagnose the most common main and root causes of claims and disputes in Iraqi building projects in order project participants to incorporate integrative claim management strategies before actual construction. A sample of 70 projects were selected for this purpose. Root cause analysis (RCA) using Fishbone diagram was employed to explore the relationships between the main and root causes of claims. The results can enable international and local professionals to adopt strategies prior to getting involved in projects and thus reduce the negative effects of early known problems with effective planning.

KEYWORDS

Construction project management; construction claims; Iraqi building projects; Root cause analysis; Fishbone diagram; Root problems.



1. INTRODUCTION

The construction industry has always been described as huge, complex, fragmented, diversified, costly, risky, and dynamic industry. It remains a good leading economic indicator for many authorities and countries. The value of global construction output is estimated to exceed 14 trillion \$ by 2030 (ARCADIS, 2022). The increase in the volume of the construction industry results from the growing demands in the global construction, which is expected for the investment in infrastructure to reach amount of 44 trillion \$ in the next 20 years (ARCADIS, 2022). Problems (claims and disputes) are represented as main effects of deficiency and low performance in construction projects. They can be either avoided, mitigated, or resolved, and/or they would escalate into more complex form, disputes whose resolutions require more expenses, time and leave adversarial impacts on parties' relationships. Many problems have become inevitable part of the construction industry (Cheung & Yiu, 2006). Understanding the types of possible occurring problems, nature, frequency and their roots (sources) can help contracting parties to develop effective problem (claim or dispute) management strategies, proactively avoid or mitigate project risks' impacts and ultimately enhance the performance of the project (Shen et al, 2017; Saad & Al maliki, 2018).

It must be always recognized that prevention is better than cure; the best time for responding to problems is as soon as possible, or in advance of the happening of a claim or dispute. Learning from previous problems therefore, and the early identification of probable problems, claims and disputes, help completing project successfully and creating a collaborative work environment in which disputes are less likely to happen (Preez, 2014; PMI, 2017). This statement declares the purpose of this study: claim and dispute management should be a forward and backward-looking task, where backward looking involves identification of root causes and prevention plans, and forward looking refers to the proper reporting, identification and resolution of inevitable problems (claims and disputes). Therefore, the aim of this research is to identify the root (source) causes of claims and disputes, their frequencies and relative importance in the Iraqi building industry. Root Cause Analysis (RCA) using Ishikawa diagram technique was employed to explore the underlying causes and root problems and relationships with the main factors that affect the performance of claim and dispute management practices. RCA enables practitioners to identify potential problems and prepare proactive plans. Taking proactive plans to avoid or mitigate the consequences of escalated claims and disputes aid avoiding going to arbitration or litigation, which are time consuming, expensive and relationship deteriorating. Providing a list of probable problems and probable effects assist management staffs add value

to future projects, avoid repeated problems and enhance the processes of decision-making (Yap et al, 2017; Dakhil et al, 2017).

2. LITERATURE REVIEW

There is some vagueness among professionals in the construction industry in recognizing the difference between the concepts of the following terms: problem, claim and dispute. They have distinct meanings. Problem refers to the basic simple form of disagreement and it is very usual situation in the construction industry. Problem is expected or unexpected situation that needs attention and consideration. Claim is a demand for something, and it is more formal, more complex and more advanced step of disagreement, and involves submission of a formal request by one party against another, for example extra money or time. Claim is an escalated situation of a problem, which has not been resolved successfully, and results from inadequate solutions or improper management of problems. It requires more expensive resources than problem treatment. Dispute is the most critical form of disagreement among the three terms. It involves harder arguments and may call for third party involvement or judiciary. Dispute is the consequence of poor management of problems and claims, and usually leaves negative impacts on the project performance and parties' relationships.

There are many studies conducted in the field of claim management and discovering their causes and types. Some of these studies have concentrated on specific area(s) of the problem, for instance, changes, delays, quality and cost overrun. Hashem & Grigg (2016) have conducted a study to predict the output of construction claims based on the characteristics of previous cases and present their corresponding methods of resolution. The study conducted by Yap et al (2017) determined the causes of design changes in construction and suggested recommendations to vanquish the related problems and build the cause-and-effect diagram. Aziz and Abdel Hakam (2016) determined construction delay causes and presented recommendations to decrease or control construction delays. Shen et al (2017) identified the sources of contractors' problems (claims) in the international Engineering, Procurement and Construction projects (EPC). Yousefi et al. (2016) introduced a model to predict the frequency of construction claims. Hasheminasab et al (2014) identified the most important and frequent problems (claims) in the gas, oil and petrochemical sector and performed root cause analysis of the problems intending to reduce the happening of disputes. Zanelidin (2006) identified the kinds, reasons and frequency of claims in construction and presented solutions to decrease or avoid disputes in construction projects. Parchami et al (2019) conducted a study to identify the most frequent claims in Iranian building industry through root cause analysis and Ishikawa

technique. On the local level (Iraq), [Erzaij \(2020\)](#) addressed the nature and causes of claims in addition to dispute resolutions in Iraqi turnkey projects. [Ali and Yassin \(2017\)](#) conducted research that dealt with disputes settlement through litigation. [Abed and Rashid \(2023\)](#) in their study identified, ordered and allocated the most critical risk factors that threaten school projects' success for the duration (2017-2022). [Khairullah et al \(2023\)](#) highlighted the most important issues and challenges facing implementation of EPC projects that follow turnkey method. [Hadi \(2017\)](#) in his paper dealt with types of claims in Iraqi construction projects and proposed a management system for controlling the impacts of claims. These studies focused on specific areas of problems, durations or specific regions, and did not aim to explore the root causes of the problems generally. The first step to avoid or mitigate a claim or dispute is to reveal the cause of the claim or dispute so that the proper plan and solution could be put in place and the proper party bears responsibility. This research has carried out a comprehensive investigation and study rather than dealing with only one area of the problem. Then, the main causes to which the root causes (problems) belong to be identified through a systematic root cause analysis by the cause and effect (Fishbone or Ishikawa) diagram. The research is structured as following:

- Literature review
- Research scope and methodology
- Discussion of results and conclusions

3. RESEARCH SCOPE AND METHODOLOGY

This paper aims to explore the most frequent main and root causes of claims and disputes in the Iraqi construction industry, their ranks based on the relative frequencies, their types and their relationships with each other so that project parties can effectively prepare integrative claim management strategies at proper time of a project. The study has focused mainly on the claims initiated between the contractors and owners in the traditional (design-bid-build) type of contracts in order to limit the scope of this research. Furthermore, the study was conducted majorly on the building type of projects in the Iraqi construction industry. It involves four main steps as shown in [Fig.1](#).

3.1. The Head Problem and Importance of Claim and Dispute Management

Disputes and claims are regarded primary measures of successful performance of construction projects and project management. Claims and disputes management and resolution have become a part of routine general management functions for project management team. The survey was conducted on selected sample projects and implied claims and disputes that have reported sufferance of the Iraqi construction projects from problems (claims and disputes).

Almost, all construction projects have been somehow impacted as a result of claims and disputes. The main impacts involved extra cost, time extension, poor quality, work suspension, termination of contract, adversarial relationships, disruptions, breakdowns, litigation ...etc. The owners incurred massive losses in effect of the escalated problems and the accompanied consequences. Identifying the main causes of poor performance of management of claims and disputes is important, but mostly insufficient. Exploring the root causes (problems) underlying behind the claims and disputes is required to visualize and recognize the full picture of claims and disputes initiation, development, management and resolution.

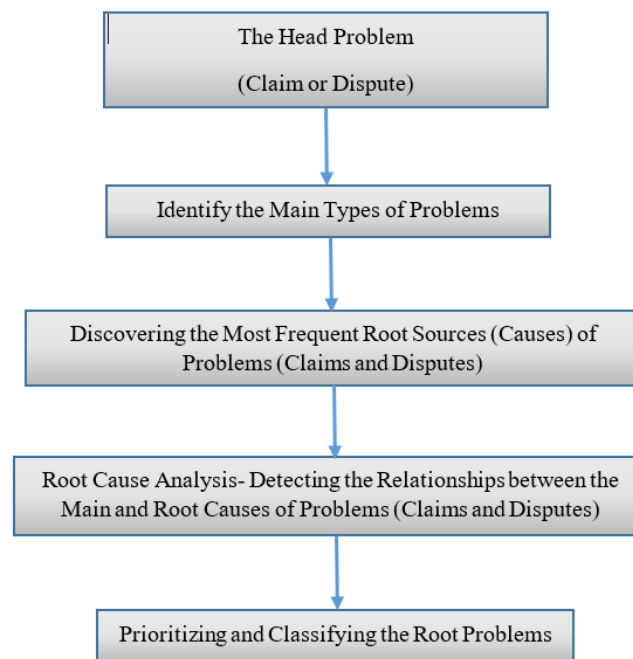


Fig. 1. The Research Methodology.

Occurrence of problems is an inevitable fact in the construction industry. Therefore, claim and dispute management is an indispensable task for professionals in the industry. Claim and dispute management tasks should be started early and expeditiously. In order to avoid a problem or mitigate its impacts, providing the relevant and sufficient information at proper time is necessary. Early understanding of problems, timely decision-making and quick responding to problems are key factors in claim and dispute management processes in the construction industry. Claim and dispute management is in some aspects, like risk management, and it consists of four processes as follows: identification of claim, quantification of claim, claim avoidance, and resolution of claim (PMI, 2007). If parties to a dispute could predict the output of the dispute resolution process with some certainty, they would have and be more ability and probably to settle the case out of litigation, that way avoiding the expensive consequences of going to courtroom.

3.2. The Main Causes of Claims and Disputes

Ghaleb (2024) conducted comprehensive dissertation research in order to identify the main types of causes of problems (claims and disputes) in the Iraqi building industry, and to build a model to predict the efficiency of claim and dispute management performance. Table 1 presents the most important categories of these main causes inserted in descending order from the most important or common cause to the lowest one. These main factors will be used in this study to classify the diagnosed root problems and compare results obtained.

Table 1. The most important main causes of claims and disputes (Ghaleb, 2024).

No.	Code	Name	Description
1	OARS	Owner Approval and Responsiveness	measures the speed of providing or performing information, approvals, tasks, acceptance and responding queries and requests by the owner
2	CEXP	Contractor Experience with the Type of Work	measures the effect of contractor experience with the type of work under consideration
3	DSCH	Work Changes	refers to the size of changes undertaken
4	COMP	Complexity of Work	measures the complexity of the work involving complexity of designs, construction, site constraints, location, ...etc.
5	OEXP	Owner Experience with the Type of Work	measures the effect of owner experience with the type of work under consideration
6	PPAY	Periodic Payment Delay	refers to the delay of issuance of the contractor's dues by the owner
7	CONS	Presence of an External Specialized Consultant	reflects the role and importance of a third consultant party to the project and dispute resolution, and also the degree to which the consultant was involved in the resolution process of the dispute or claim
8	PRIO	Priority of the Project for the Owner	importance and degree of urgency of the project for the owner
9	INFL	Increase in Prices	measures the impact of inflation and exchange rates on the construction projects
10	PDEL	Project Delay	reflects the effect of being the project late or not, on the efficiency of claim or dispute management

3.3. The Root Causes of Claims and Disputes (Source Problems)

A thorough survey was carried out on a sample consists of 70 cases of construction projects selected randomly. The sample cases involved projects from various Iraqi government ministries including ministry of construction and housing, ministry of industry and minerals, ministry of interior, Border Ports commission, and ministry of higher education and scientific research. They included projects executed in the interval between (2008-2023). Their construction costs range from one to one hundred billion Iraqi Dinar (IQD). The sample project cases from which the root causes of problems were investigated comprised (10%) residential,

(10%) industrial, and (80%) institutional building projects. Their locations were geographically distributed over multiple sites and different Iraqi governorates including: Baghdad, Basra, Qadisiyah, Diyala, Karbala, Kirkuk, Maysan, Najaf, Ninawa, Salah Al-Din and Wasit. The survey involved all the potential root causes of claims and disputes originated between project parties. Table 2 displays the recorded root causes of problems sorted in descending order according to their frequencies (number of occurrence or observations in the sample projects).

Table 2. The root causes of claims and disputes with their frequencies in the sample projects.

No	Root Problem (Cause)	Code	Frequency
1	Late issuance of contractor payments	PPAY1	44
2	Low productivity (contractor)	CEXP1-5	38
3	Ineffective progress schedule	CEXP3	38
4	Insufficiency of contractor workforces	CEXP1-1	36
5	Unforeseen conditions	COMP3	36
6	Site obstructions	COMP2	36
7	Poor owner experience	OEXP1	34
8	Work breakdown caused by site obstructions	PDEL3	32
9	Designs and drawings modifications	DSCH1-1	32
10	Incompleteness of designs	DSCH1-2	32
11	Late approval over changes	DSCH3	32
12	Non-use of weighting factors when prioritizing tenders	CEXP2-2	30
13	Lateness caused by variations	PDEL1-1	30
14	Late RFI responses by owner	OARS3	30
15	Difficult site conditions	COMP4	30
16	There is no specialized external consultant	CONS1-1	30
17	Defective designs and drawings	DSCH1-3	28
18	Late permits regarding site access	OARS4	28
19	Noncompliance to consultant and resident engineer directions	CEXP4	26
20	Lateness caused by inexistence of consultant	CONS1-1	26
21	Site clearance and late giving of possession	OARS5	26
22	Late contracting with consultant	CONS1-3	26
23	No enough finances or allocations	PPAY3	26
24	Blurred or insufficiency of contract award criteria	CEXP2-1	24
25	Poor financial position (contractor)	CEXP1-3	24
26	Work breakdown due to late payments	PDEL5	24
27	Lateness due to late variation acceptance	OARS2	24
28	Additional and deleted work quantities	DSCH2	24
29	Difficult site access caused by owner	COMP1-3	24
30	Late changes financing by owner	PPAY2	24
31	Technical inadequacy (contractor)	CEXP1-2	22
32	Late contract signing due to incompleteness of contracting requirements	PDEL6	22
33	Late invitation sent to external consultant	CONS1-2	22
34	Retardation of contractor at the kick-off	CEXP1-4	20
35	Lateness due to incomplete designs and drawings	PDEL7	20
36	Late changes acceptance and approval	DSCH3	20

No	Root Problem (Cause)	Code	Frequency
37	Confusion of designs, drawings and BoQs	DSCH1-5	20
38	Difficult site access	COMP1-1	20
39	Underground obstructions and foundation changes	DSCH4	18
40	Prolonged contract draft preparing and rectifying	OARS1-1	18
41	Lengthy period between awarding and contract signing	OARS1-2	18
42	Late issuance of consultant dues	PPAY4	18
43	Retardation due to late site access acceptance	OARS4	16
44	Late delivery of required designs	PDEL1-2	16
45	Material and specifications changes	DSCH5	16
46	Force majeure and crises	COMP5	16
47	Complicated transferring of materials and equipment	COMP1-2	16
48	Poor management (contractor)	CEXP1-5	14
49	Poor relationships between contractor workforces	CEXP1-6	14
50	Late approval over agreed breakdowns	OARS6	14
51	Late consultancy contract signing	CONS1-4	14
52	Late responses by consultant	CONS2	14
53	Bad work	CEXP5	12
54	Lengthy designs and drawings preparing period by owner	OARS7	12
55	Prolonged contract addendum preparing and rectifying	OARS1-3	12
56	Price disruptions or changes during construction	INFL1	12
57	Late taking over construction site	OARS4	10
58	Retardation caused by poor relationships	PDEL9	10
59	Compensation claims of breakdowns caused by owner	PDEL10	10
60	Inexistence of specific designs and drawings	DSCH1-4	10
61	Change in construction site location	DSCH6	10
62	Poor relationship with consultant	CEXP8	8
63	Employment of new workforces or subcontractors	CEXP7	8
64	Variation in building coordinates and elevations	DSCH10	8
65	Designs and changes approval by external sectorial parties	DSCH8	8
66	Performing changes without or late owner notifications	DSCH7	8
67	Ineffectiveness of external consultant services	CONS1-5	8
68	Changes in exchange rate	INFL2	8
69	Retardation caused by wrong execution	PDEL11	6
70	Errors in the relevant payment application documents	PPAY5	6

3.4. Root Cause Analysis (RCA)

The concepts of claims and disputes in construction are not new, but the most important point is to discover the root causes of disputes and expect potential problems of a project and how to treat them. RCA is an effective method of problem solving that identifies the root causes of problems, claims and disputes. It is a key step in quality and improvement of reliability (Mulenga et al, 2017). RCA has the ability to prevent problems from recurring (Rosenfeld, 2013). It is typically adopted to find out the underlying causes that might result in a problem and help preparing preventive plans. The procedure starts with stating a problem to identify threats and then discovering which threats might lead to that problem happening. In the same

way, the technique can be adopted to identify opportunities through statement of benefits, and thus exploring the opportunities that lead to the benefits hoped.

RCA is a structured facilitated process used to identify the root causes of a problem that resulted in an undesired outcome and to propose solutions. RCA's intent is to find out what happened, why, and understand what changes needed to be performed.

A comprehensive investigation was conducted on the sample Iraqi construction projects and their involved problems, claims and disputes. The survey involved all potential root problems that may be related to the main causes of problems, which are the main causes under which the root problems have been grouped. Cause and effect diagram tool was utilized to visualize and describe the relationships between the main and root problems. Ishikawa diagram is a powerful technique to discover which causes or problems have what and more effect on which main problems. It would be obvious what needs correcting or planning after performing a cause-and-effect diagram. [Fig.2](#) visualizes in bar chart the frequencies of the main factors (problems) calculated by cumulating the frequencies of the root problems underlying the relevant main problem, and [Fig.3](#) displays the main diagram showing generally the relationship between the main causes and root causes of claims and disputes.

4. RESULTS AND DISCUSSION

In this study, the issues that may seem to be the main causes of the problem (claim and dispute) were considered as the fishbone factors. These nine factors include Owner Approval and Responsiveness, Contractor Experience with the type of Project, Work Changes, Complexity of Work, Owner Experience with the type of Project, Periodic Payment Delay, Ineffective or inexistence of an External Specialized Consultant, Increase in Prices, and Project Delay. For example, the complexity of work factor involves claims and disputes that relate for instance to complexity of work designs, construction methods, site work difficulty and location; as an example, the root cause COMP3 relates to unforeseen conditions, which has been put under the factor complexity of work (P_COMP) in the Fishbone diagram. The factor (Priority of the Project for the Owner) was excluded from the root cause analysis since the sample claims and disputes cases did not involve problems or issues that underlie this factor. This is because the construction projects from which the sample cases were collected, have generally the same level of priority or importance, and there were not projects with low importance.

[Fig.3](#) illustrates the main cause and effect diagram used in this research. In the presented diagram, the main causes (factors) are placed from the most frequent to the fewest one, from the fish's head toward its tail. Thus, the two main factors in the fish tail are (Increase in Prices) and (Owner Experience with the Type of Work) as they have lower number of occurrence of

problems than the other factors. The factors (Contractor Experience, Project Delay and Work Changes) are put in the fish's head because problems of these types have greater number of occurrence than other factors.

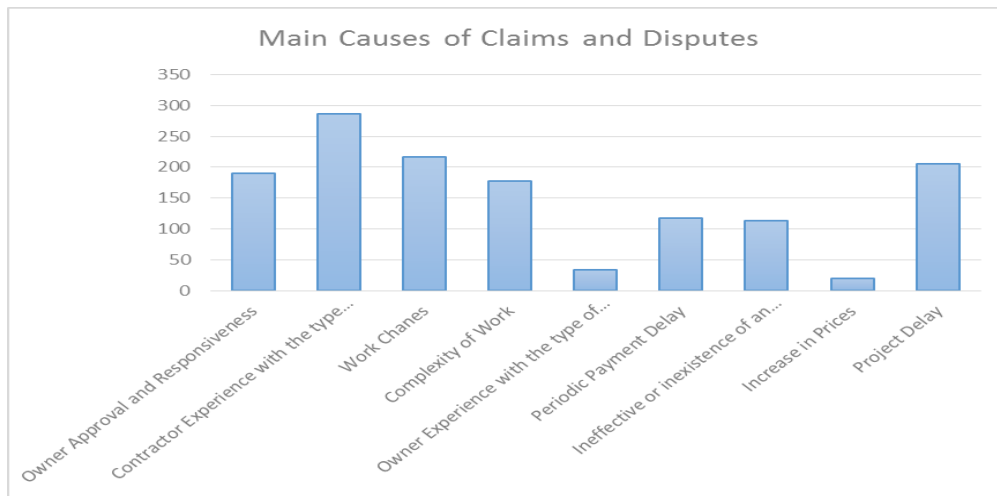


Fig. 2. Main causes of claims and disputes and their influence based on their involved root causes frequency.

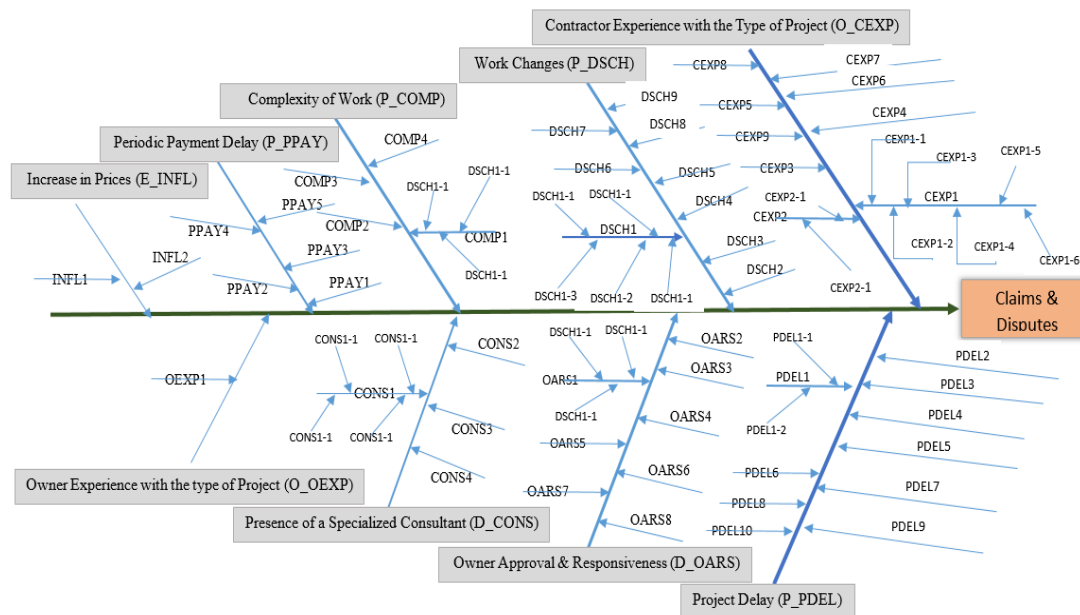


Fig. 3. The root causes and their relationships with the main causes of claims and disputes.

70 items of root causes of claims and disputes were determined as the most common problems in the Iraqi building industry. They are categorized in accordance with the nine main causes (factors) and depicted in Ishikawa diagram and placed from the most frequent root cause to the fewest one from the nearest point from the backbone line of the diagram to the farthest point on the relevant main cause branch. The main causes of claims and disputes are depicted diagrammatically according to the frequency of the related root causes of problems in Fig.2. According to the latter figure, a considerable part of the claims (21%) is caused by problems

related to the selection of contractor based on experience with the type of project; the percentage rate was calculated by dividing the frequency of the relevant root problem on the total frequency of all root problems. About 16% of the root problems are resulted from changes or variations. 15%, 14% and 13% of the root causes are due to problems related to project delay, speed of owner approval and responding, and complexity of work, respectively. Approximately, 80% of the root causes of claims and disputes are resulted from problems relate to the first five main causes of problems identified in [Fig.2](#).

5. CONCLUSIONS

Claims and disputes have a considerable impact on the primary three elements of successful construction projects involving time, cost and quality. Furthermore, they have direct effect on project parties' relationships, collaborative working and the total performance of projects. This emphasizes the importance of claims and disputes management. A proper strategy for effective and efficient management of claims and disputes can be built on known problems with the use of history of problems. Consequently, by reviewing existing related studies and surveying a sample of Iraqi building projects consists of 70 project cases, 70 items of root causes and nine main causes were determined as the reasons of frequent claims and disputes in Iraqi building industry. Root cause analysis utilizing cause and effect diagram, supported by a thorough investigation of 70 sample cases of building projects, was conducted to identify the most frequent problems, and depict the relationships between the main causes and the diagnosed 70 root causes of claims and disputes.

The results showed high relative frequencies for the root problems underlying the following main predictors identifies by [Ghaleb \(2024\)](#): Contractor Experience with the type of Work, Work Changes, Project Delay, Owner Approval and Responsiveness, Complexity of Work, Presence of External Specialized Consultants, and Periodic Payment Delay. Accordingly, this study confirmed the importance of these factors as proved by [Ghaleb \(2024\)](#), except for the factor (Project Delay), which came at the end of the main variables in the latter research and came second in this study. This may due to two reasons. First, this study focuses primarily on the frequency of problems rather than the impact of such issues on the projects. Second, may due to the fact that the delays in Iraqi construction projects became a phenomenon, and it is most inescapable. Furthermore, the other variables may had taken over a part of this factor's effect. Thus, its effect as a main reason for claims and disputes was absent or macerated in the study conducted by [Ghaleb \(2024\)](#), and the RCA conducted in this study showed the actual frequency of delays.

The study conducted by [Abd Ali & Yassin \(2017\)](#) confirms that contractor-related claims and disputes are one of the most influence sources in construction as displayed in this study. the research carried out by [Abed & Rashid \(2023\)](#) revealed the high impact of periodic payment delays and work changes risks on stimulating claims and disputes. [Hadi \(2017\)](#) conducted a study showed that work changes, complexity of work, periodic payment delay, and project delays represent main causes of claims and have a considerable impact on project costs and durations. These results agree to some extent with the results obtained in this study since work changes, project delays, complexity of work and periodic payment delay factors came into the third, second, fourth and sixth ranks, respectively, among the most affecting factors. The research performed by [Mohammed \(2016\)](#) in its results indicated the most significant risks, which are poor owner financial position (i.e. periodic payment delay), inexperienced contractor, work changes, poor experience of owners, and late owner approval and responding. These risks came in the sixth, first, second and fourth ranks according to the results obtained in this research. The results of this study generally showed a good convergence with the above compared studies. About 80% of claims and disputes are resulted from poor contractor selection process, variations, delays, late owner responding and approvals, and complexity of work.

With the aid of the diagnosed problems and their roots from experiences and best practices, claims and disputes can be predicted and solutions planned before occurrence. The aim of this study is that its results can aid professionals involved in Iraqi building industry to determine the situations that lead to claims and disputes, avoid or mitigate the impacts of frequent problems, reduce time and cost overrun and other negative effects. The limitations that the researchers met to perform the current study were complexity of construction project contracts, massiveness of projects' documents, and difficulty of accessibility to projects' documents and information.

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